

New records of Maned Wolf, *Chrysocyon brachyurus* (Illiger, 1815), in Rio Grande do Sul, Brazil: consequences for conservation

Juliana Nascimento Martins¹, Cassiano Alves Marchett¹, Eduardo Benson Santos Barboza¹, Samantha Lamperti de Oliveira¹, Bruno Polese Raminelli¹, Rodrigo Cambará Printes²

¹ Tecniflora Assessoria e Planejamento Florestal Ltda., Caxias do Sul, Brazil

² Laboratório de Gerenciamento Costeiro, Instituto de Oceanografia, Universidade Federal do Rio Grande, Rio Grande, Brazil

Corresponding author: Juliana Nascimento Martins (tecniflora@tecniflora.com.br)

Abstract. We document records of *Chrysocyon brachyurus* (Illiger, 1815), Maned Wolf, from on a private farm in the municipality of Cambará do Sul, Rio Grande do Sul, Brazil. The farm borders Parque Nacional da Serra Geral, near Fortaleza Canyon. Twelve new records of Maned Wolf were captured with camera traps between 16 March 2023 and 10 November 2023, in five locations. These records are of significance due to the rarity of this species in Rio Grande do Sul.

Key words. Cambará do Sul, camera trap, Canidae, national park, Maned Wolf, Threatened species

Martins JN, Marchett CA, Barboza EBS, Oliveira SL, Raminelli BP, Printes RC (2024) New records of Maned Wolf, *Chrysocyon brachyurus* (Illiger, 1815), in Rio Grande do Sul, Brazil: consequences for conservation. Check List 20 (1): 212–220. <https://doi.org/10.15560/20.1.212>

INTRODUCTION

Maned Wolf, *Chrysocyon brachyurus* (Illiger, 1815), is the largest canid in South America, with a weight ranging of 20–33 kg (Paula et al. 2013) and a height at the shoulder of 90 cm (Emmons et al. 2012). Individuals are primarily active during dusk and at night (Dietz 1984) and have an omnivorous, generalist, and opportunistic feeding behavior; they act as seed dispersers, particularly for *Solanum lycocarpum* A.St.-Hil., in the Brazilian Cerrado (Dietz 1984; Santos et al. 2003; Jácomo et al. 2004; Rodrigues et al. 2007; Bueno & Motta-Junior 2009; Queirolo et al. 2011; Paula et al. 2013). They are solitary and monogamous, and individuals have a home range of 20–115 km² (Dietz 1984; Paula et al. 2013; Paula and DeMatteo 2015).

Maned Wolves live in open habitats along central South America, typically occurring in the Cerrado, Chaco, and Pampa in Brazil (Dietz 1985; Coelho et al. 2008; Queirolo et al. 2011; Silva-Diogo et al. 2020). This species is still present in northeastern and southern Rio Grande do Sul, the southernmost Brazilian state. The species persists in northern and eastern Bolivia, southeastern Peru, and Paraguay. In Argentina, this species is present in northeastern, central, and eastern part of the country. There are a few records of Maned Wolves in Uruguay (Queirolo et al. 2011).

This species has been expanding its area of distribution to eastern Brazil for more than a decade, and this expansion has been associated with deforestation and conversion of forests into pastures (Queirolo et al. 2011; Bereta et al. 2017). In the Amazon biome this species has recently expanded its distribution by about 51,000 km² (Silva-Diogo et al. 2020). Deforestation in the Atlantic Forest regions of southeastern and eastern Brazil has contributed to the expansion of Maned Wolf into areas it did not previously inhabit (Paula et al. 2013). As a result, sightings in Atlantic Forest areas of the states of Paraná, São Paulo, Rio de Janeiro, and Minas Gerais have increased in recent years (Queirolo et al. 2011; Xavier et al. 2017; Muscat et al. 2021).

Due to its large geographic distribution, Maned Wolf is not a threatened species according to International Union for the Conservation of Nature (IUCN) criteria, but it is classified as Near Threatened due to projected habitat loss in the future (Paula and DeMatteo 2015). This species is listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In Brazil, the list issued by Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), which uses IUCN criteria, has assessed Maned Wolf as Vulnerable (Brasil 2014). However, in Rio Grande do Sul, this species is considered Critically Endangered since 2014 (Rio Grande do Sul 2014), and in Santa Catarina, likewise Critically Endangered since 2011 (Santa Catarina 2011).

There are few records of Maned Wolf from southern Brazil, which suggests that the species has always been rare in the southern limits of its range (Queirolo 2014). Salvador et al. (2019) last revised the species'



Academic editor: Terrence C. Demos

Received: 24 October 2023

Accepted: 29 January 2024

Published: 9 February 2024

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geographic distribution in that region, compiling 10 new records over a 17-year period, with only six coming from direct observations, all within Santa Catarina state. Historical documentation of this species' presence in Rio Grande do Sul is scarce (Indrusiak and Eizirik 2003; Marques and Fábian 2013; Pinto and Duarte 2013; Queirolo 2014; Queirolo 2016; Kasper et al. 2023). The Maned Wolf had already been considered rare in the 1920s (Ihering 1927).

Kasper et al. (2023) carried out intensive studies in Rio Grande do Sul between 2015 and 2020 using camera traps and searches for traces. They focused on three areas in the Campos de Cima da Serra region and two in the Pampa region to confirm the presence of the species after reports of occasional sightings and did not obtain any new records.

Records of Maned Wolves recently published by Kasper et al. (2023) are from photographs taken by tourists and local residents, and road-killed animals: two photographs taken by tourists in the Parque Nacional de Aparados da Serra in the municipality of Cambará do Sul (2010 and January 2023); two photographs in São José dos Ausentes (August 2016 and January 2022); one photograph by a local rural resident in Encruzilhada do Sul; and a road-killed individual in São Borja.

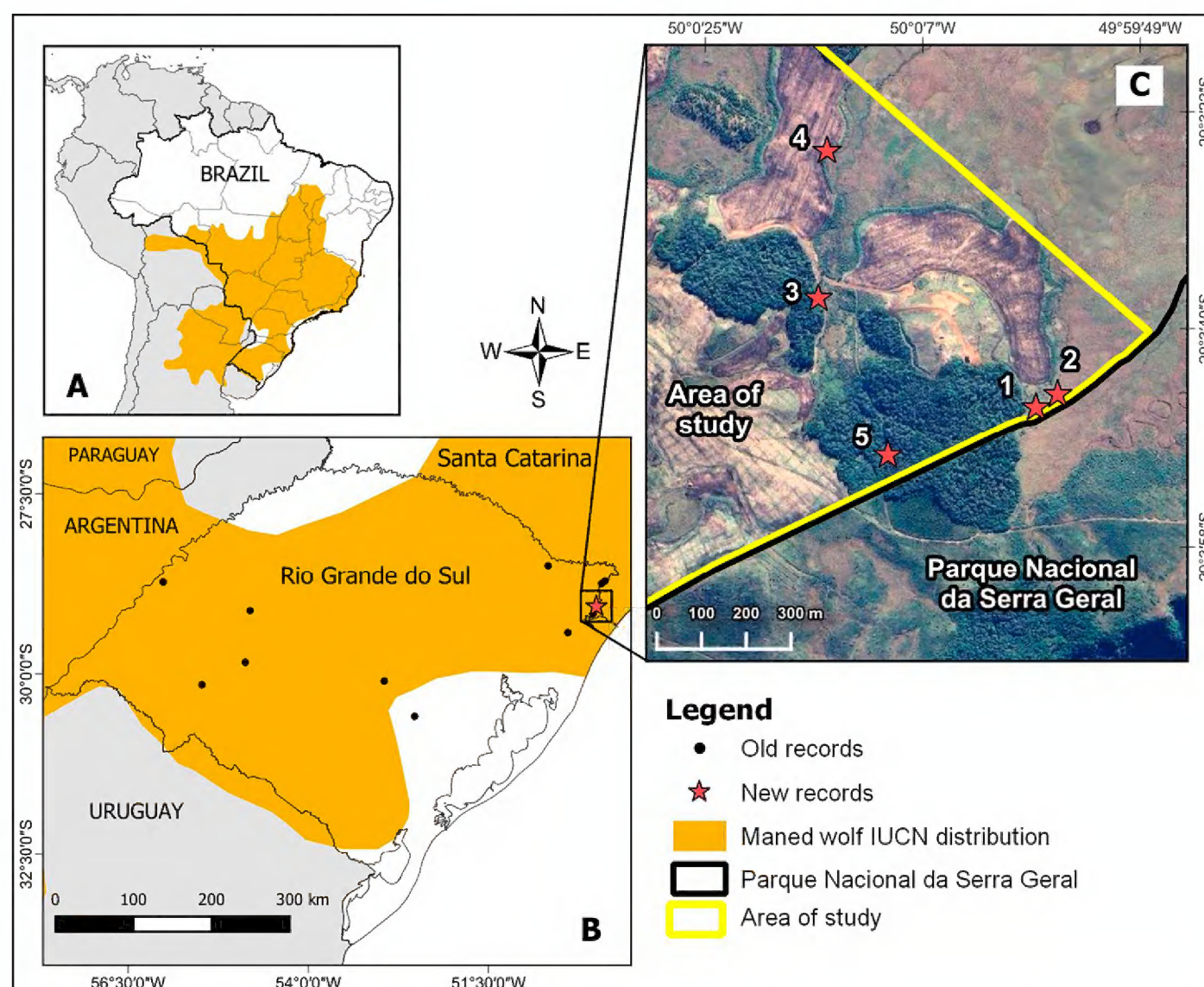
Thus, this work aims to present consistent data on the occurrence of Maned Wolf, *Chrysocyon brachyurus*, in the municipality of Cambará do Sul, state of Rio Grande do Sul, Brazil, through scientific methods.

METHODS

The records were collected as a part of a wildlife monitoring project on a privately owned farm in the municipality of Cambará do Sul, state of Rio Grande do Sul, Brazil (−29.0683, −050.0133, WGS 84 datum; Figure 1). This farm encompasses an area of 1,176 ha and is planted with corn in addition to cultivation of *Pinus taeda* L. The farm is within the Atlantic Forest biome, in the phytogeographic region of the Grassy-woody steppe with gallery forest and Araucaria forest. The farm is approximately 1,050 m above sea level. The region's climate is Cfb (humid temperate) according to the Köppen classification (Peel et al. 2007). The average annual temperature is 15.1 °C, with a maximum temperature of 26 °C and a minimum temperature of 4 °C; the average annual rainfall is 1,832 mm, with December being wettest (236 mm) and August driest (70 mm) (Wrege 2011).

The farm is located within the buffer zone of the Parque Nacional da Serra Geral, near Fortaleza Canyon. The Parque Nacional da Serra Geral is a Brazilian federally protected area that spans the border between the states of Rio Grande do Sul (RS) and Santa Catarina (SC), and including the municipalities of Cambará do Sul (RS), Jacinto Machado (SC), and Praia Grande (SC) (Figure 1). The Parque Nacional da Serra Geral was created by Decree No. 531 of 1992 and has an area of 17,300 ha. It is adjacent to the former Parque Nacional de Aparados da Serra, created in 1959 by Federal Decree No. 47,446, with an area of 10,250 ha. In practice, the two parks are managed as a single territory, with a single management plan and

Figure 1. Occurrence of Maned Wolf in the state of Rio Grande do Sul, Brazil. Black circles indicate the previously published occurrence records in the scientific literature; red stars indicate the new records. **A.** Part of South America, with Brazil highlighted and Maned Wolf distribution according to the IUCN (Paula and DeMatteo 2015). **B.** Old and new records of Maned Wolf in Rio Grande do Sul. **C.** Part of the study area where there were new records of Maned Wolf, near the Parque Nacional da Serra Geral.



an integrated buffer zone. Both parks protect several canyons, which constitute ecosystems of rare beauty, with great importance for biodiversity and tourism. The buffer zone is an area established around the parks as defined in the joint management plan of the Parque Nacional de Aparados da Serra e Serra Geral (MMA/IBAMA 2019). In the buffer zone, human activities are subject to restrictions and special rules aimed at guaranteeing the conservation of biodiversity within the parks. In April 2022, UNESCO recognized these parks as part of the Caminhos dos Cânions do Sul Global Geopark.

Data were collected between July 2021 and November 2023 using SunGus, Suntekcam, Mini301, Mini600, Creative XP, and Bushnell digital camera traps. The total sampling effort totaled 4,264 trap-days. The equipment was distributed throughout the study area and remained active 24 hours per day, set to record in video format. These traps were installed in grassland, wetland, forest areas, and along a path between the plantation and wetland.

The camera traps were checked monthly. Memory cards were inspected in the field using a tablet, and camera batteries were replaced on the same occasion. The images were screened, and the best ones were stored in a digital file, becoming available for confirmation and analysis.

The camera trap records were corroborated by Maned Wolf tracks. The tracks were analyzed, subjected to expert assessment, and compared with similar records in the literature (Borges and Tomás 2004; De Angelo et al. 2008).

The Maned Wolf’s geographic range was obtained from the IUCN Spatial Data Download (<https://www.iucnredlist.org/resources/spatial-data-download>) (Paula and DeMatteo 2015) and the data were plotted on a thematic map prepared in QGIS v. 3.28.4 (QGIS Development Team 2022). Coordinates and elevation were recorded in the field using a Garmin GPSMAP 76Cx GPS receiver using the WGS 84 datum and elevations in meters.

Data from old records were obtained from the scientific literature, but information without geographical coordinates was not considered.

RESULTS

Twelve new Maned Wolf records were obtained at five locations at the farm (Table 1). These sites are located within a landscape comprising corn plantations, a fragment of native forest, and a large wetland connecting the private property to the Parque Nacional da Serra Geral.

Table 1. Previous published records of maned wolf and the new records (monitoring point #) in Rio Grande do Sul, southern Brazil, including the record year or date, record type, locality, geographical coordinates, datum and note (information source).

Monitoring point #	Year or date	Record type	Locality	Geographical coordinates	Datum	Note
	1984	Museum (UFSC 341)	Bom Jesus	−28.4917, −050.6722	—	Salvador et al. 2019
	1987	Museum (UFSC 342)	Bom Jesus	−28.4167, −050.5000	—	Salvador et al. 2019
	2009	Camera trap	Rio Ibicuí, Cacequi	−29.8389, −054.8727	SAD 69	Pinto and Duarte 2013
	2009	Camera trap	Floresta Nacional de São Francisco de Paula	−29.4275, −050.3968	—	Marques and Fábian 2013
	2009	Pers. comm.	Alegrete, Serra do Caverá	−30.1471, −055.4735	WGS 84	Queirolo 2016
	—	Pers. comm.	Santiago	−29.1217, −054.8064	WGS 84	Queirolo 2016
	—	Pers. comm.	Cachoeira do Sul	−30.0955, −052.9462	WGS 84	Queirolo 2016
	2010	Photo	Parque Nacional de Aparados da Serra	−29.0842, −049.9969	WGS 84	Kasper et al. 2023
	2016	Photo	São José dos Ausentes	−28.7472, −049.9250	WGS 84	Kasper et al. 2023
	2017	Carcasse	São Borja	−28.7251, −056.0125	WGS 84	Kasper et al. 2023
	2021	Photo	Encruzilhada do Sul	−30.5941, −052.5233	WGS 84	Kasper et al. 2023
	2022	Social media	São José dos Ausentes	−28.7123, −049.8795	WGS 84	Kasper et al. 2023
	2023	Press	Parque Nacional de Aparados da Serra	−29.1719, −050.0460	WGS 84	Kasper et al. 2023
1	16.III.2023, 20.III.2023	Camera trap	Cambará do Sul	−29.0628, −049.9994	WGS 84	This study
2	18.VI.2023, 18.VIII.2023, 15.X.2023, 10.XI.2023	Camera trap; sighting	Cambará do Sul	−29.0625, −049.9989	WGS 84	This study
3	19.VI.2023	Tracks	Cambará do Sul	−29.0603, −050.0044	WGS 84	This study
4	21.VI.2023, 07.IX.2023, 25.X.2023	Tracks; camera trap	Cambará do Sul	−29.0569, −050.0042	WGS 84	This study
5	27.VI.2023, 24.X.2023	Camera trap	Cambará do Sul	−29.0639, −050.0028	WGS 84	This study



Figure 2. Maned Wolf, *Chrysocyon brachyurus*, in Cambará do Sul, Rio Grande do Sul, Brazil. **A.** Camera trap record from August 2023. **B.** Track from June 2023 following records by camera trap and direct observation. **C.** Camera trap record from October 2023.

The first records were made on 16 March 2023 and on 20 March 2023 at monitoring point #1, after 35 and 39 trap-days, respectively. On the day the camera trap was installed, a farm employee accompanied the team along with a dog, which urinated upon reaching the destination. In the videos, a Maned Wolf approached and smelled the spot. In the first recording, it approached from the direction of the national park, and in the second recording it passed in front of the camera trap while coming from the farm.

Another record was obtained on 18 June 2023 (monitoring point #2) in a camera trap (after 39 trap-days). A direct observation was made at the same time, as reported by farm employees, who spotted the animal moving towards the national park. In the same week, complementary records were obtained through the detection of tracks (Figure 2B), revealing the places where this individual had traversed within the study area (points #3 and #4). These tracks revealed that this Maned Wolf had been in the recently harvested corn plantation.

The fourth record was made in a camera trap positioned along a pathway that cuts through a patch of native forest near the border with the national park. This path had been monitored since 24 May 2022, and on 27 June 2023, after 547 trap-days, the camera recorded a wolf for the first time (point #5). At the same point, we have a record made on 24 October 2023, after 732 trap-days.

Additional records were made at the second monitoring point (#2), within a wetland, on 18 August 2023 (Figure 2A), 15 October 2023, and 10 November 2023, after 100, 158 and 184 trap-days, respectively. On 07 September 2023 a record was made at the same region of through the detection of tracks (monitoring point #4) on a path between the plantation and wetland (after 78 trap-days), which was repeated on 25 October 2023 (after 126 trap-days) (Figure 2C).

Individual morphological characteristics detected in the videos suggest that the records are of two adult individuals. It was not possible to determine the sex of the individuals.

New records. BRAZIL – RIO GRANDE DO SUL • Cambará do Sul; -29.0628, -049.9994; 1,020 m alt.; 16.III.2023; J.N. Martins, C.A. Marchett, S.L. de Oliveira, E.B.S. Barboza, B.P. Raminelli obs.; 1 adult, sex indet. • -29.0628, -049.9994; 1,020 m alt.; 20.III.2023; J.N. Martins, C.A. Marchett, S.L. de Oliveira, E.B.S. Barboza, B.P. Raminelli obs.; 1 adult, sex indet. • Cambará do Sul; -29.0625, -049.9989; 1,020 m alt.; 18.VI.2023; J.N. Martins, C.A. Marchett, E.B.S. Barboza obs.; 1 adult, sex indet. • Cambará do Sul; -29.0603,

–050.0044; 1,040 m alt.; 19.VI.2023; J.N. Martins, E.B.S. Barboza, B.P. Raminelli obs.; 1 adult, sex indet. • Cambará do Sul; –29.0569, –050.0042; 1,015 m alt.; 21.VI.2023; J.N. Martins, S.L. de Oliveira, E.B.S. Barboza obs.; 1 adult, sex indet. • Cambará do Sul; –29.0639, –050.0028; 1,040 m alt.; 27.VI.2023; J.N. Martins, C.A. Marchett, S.L. de Oliveira, E.B.S. Barboza obs.; 1 adult, sex indet. • Cambará do Sul; –29.0625, –049.9989; 1,020 m alt.; 18.VIII.2023; J.N. Martins, C.A. Marchett, E.B.S. Barboza obs.; 1 adult, sex indet. • Cambará do Sul; –29.0569, –050.0042; 1,015 m alt.; 07.IX.2023; J.N. Martins, E.B.S. Barboza obs.; 1 adult, sex indet. • Cambará do Sul; –29.0625, –049.9989; 1,020 m alt.; 15.X.2023; J.N. Martins, C.A. Marchett, E.B.S. Barboza obs.; 1 adult, sex indet. • –29.0639, –050.0028; 1,040 m alt.; 24.X.2023; J.N. Martins, C.A. Marchett, S.L. de Oliveira, E.B.S. Barboza obs.; 1 adult, sex indet. • Cambará do Sul; –29.0569, –050.0042; 1,015 m alt.; 25.X.2023; J.N. Martins, E.B.S. Barboza obs.; 1 adult, sex indet. • Cambará do Sul; –29.0625, –049.9989; 1,020 m alt.; 10.XI.2023; J.N. Martins, C.A. Marchett, E.B.S. Barboza obs.; 1 adult, sex indet.

Identification. Maned Wolf can be easily identified by its larger body size compared to other native canids that occur in Brazil, which are Crab-eating Fox, *Cerdocyon thous* (Linnaeus, 1766), and Pampas Fox, *Lycalopex gymnocercus* (G. Fischer, 1814). The reddish fur, long black legs, large ears, and the distinctive shape of the head are unmistakable characteristics of this species. The high-quality footage obtained by our camera traps enabled easy and accurate identification of the species.

DISCUSSION

These new records of Maned Wolf hold great importance to the biogeography and conservation of this species. Our new data draw attention to the importance of the conservation of the Campos de Cima da Serra, which is a high-altitude grassland ecosystem associated with the Atlantic Forest biome in Brazil, near the southern limit of the distribution of the Maned Wolf.

This is the first study which presents recurrent records of Maned Wolf from the municipality of Cambará do Sul and from the state of Rio Grande do Sul. Our data suggest that there are, at least, two adult animals present at the farm.

The number of records is unprecedented for Rio Grande do Sul, and the recurrence of appearances of the same individuals suggests that these animals are residents here, making our study the first to monitor of Maned Wolves in Rio Grande do Sul. It is noteworthy that these wolves were on a private farm neighboring the Parque Nacional da Serra Geral; this highlights both the importance of this protected area and the need for conservation efforts to integrate with surrounding private areas (Schulz et al. 2014). In addition, we confirm the presence of Maned Wolves in the Parque Nacional da Serra Geral, as at least one of the animals spotted was moving between the private property and the protected area.

Over the last few years there have been sporadic records of Maned Wolves published on the internet, in the news, and on social networks. These sightings were in the municipality of São José dos Ausentes (2016 and 2002) and in Cambará do Sul, in the Parque Nacional de Aparados da Serra (2010 and January 2023) (Kasper et al. 2023).

Maned Wolf tracks were found in corn plantations on the farm, soon after the harvest. This suggests that these animals may be foraging on leftover corn. Indeed, Maned Wolves do eat corn (Dietz 1984; Rodrigues et al. 2007). Furthermore, corn plantations provide food for birds and small rodents, which are important prey for this species (Aragona and Setz 2001; Massara et al. 2012; Rosa et al. 2015), and Maned Wolves are somewhat adaptable to anthropogenic habitats (Motta-Junior 2000).

These new records may be linked to a decrease in hunting pressure on wild animals in Cambará do Sul, which may be due to a change in the attitude of the local population, since locals have become economically dependent on tourism. An increase in enforcement within national parks may also have reduced killings of wolves.

Consequences for conservation. The limited availability of information on the geographic distribution of Maned Wolf, especially along its southern limits, prevents us from determining whether our new records represent a recent population expansion of the species and whether they should be understood as small, isolated populations or even isolated, dispersing individuals (Mac Allister 2021).

However, our new records of Maned Wolf stirred the interest in researching the population in southern Brazil. These surveys must consider population size, diet, home range, and dispersal routes.

At the moment, potential pressures and threats identified for the species are from tourists visiting the Parque Nacional da Serra Geral using motorized vehicles, which can cause roadkill; motor vehicles are a frequent cause of mortality for this species in other regions (Silva 1984, 2016; Silveira 1999; Rodrigues 2002; Paula et al. 2008). Another risk is associated with the presence of hunters (Paula et al. 2008; Queirolo et al. 2011); the hunting Wild Boar (*Sus scrofa*) is legal in the region. Due to their large home range, Maned Wolves may circulate outside of protected areas (Rodrigues 2002), and it is very important that surrounding landowners are informed and sensitized to this. Furthermore, Maned Wolves in proximity with domestic animals, mainly with other canids, is a threat, as this can expose wolves to attacks (Silva 2016; Orozco et al. 2022) and diseases like canine distemper virus, parvovirus (Cleaveland et al. 2000; Whiteman

et al. 2007; Lacerda et al. 2009; Megid et al. 2010), and sarcoptic mange (Luque et al 2014; Feliciano 2022; Fiori et al 2023).

Our records are mainly from open areas of the farm, demonstrating that open habitats are preferred by Maned Wolf, as observed elsewhere in the country (Coelho et al. 2008; Paula et al. 2013; Aximoff et al. 2020; Silva-Diogo et al. 2020). However, restoration of native vegetation is not a priority of landowners and restoration would require a financial incentive (Henderson et al. 2015).

It would be interesting to develop a participatory monitoring project (Lockschin et al. 2007) for Maned Wolf in and around the Parque Nacional da Serra Geral and Parque Nacional de Aparados da Serra. Such a project could involve the gathering of fortuitous observations by tourists and residents of the properties surrounding the parks. As well as helping to monitor the population, a project of this kind has great appeal for environmental education (Printes et al. 2010).

ACKNOWLEDGEMENTS

We extend our deepest gratitude to Eduardo Anselmi, Reni Anselmi, Anselmi Participações, and Malharia Anselmi for funding the research. We thank Rogério Cunha de Paula and Fábio Dias Mazim for their assistance in identifying Maned Wolf tracks. We are also grateful to Washington Luiz dos Santos Ferreira for contributions, and to Fabiano Anselmi and Ivonete Anselmi for providing information about the sighting cited in this study. We thank the IUCN for providing distribution data. To the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), Leonardo Ferreira de Brito, Ubirajara Martins and Fábio Dias Mazim, thank you for your support and encouragement. We are also thankful to Paulo Barradas and Aldo José Pinheiro Dillon for his help in revising our English, as well as to the anonymous reviewers and the academic editor.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

Funding


This study was financially supported by Eduardo Anselmi, Anselmi Participações, and Malharia Anselmi.


Author contributions

Conceptualization: JNM, RCP, CAM. Data curation: JNM, EBSB, SLO. Formal analysis: JNM, RCP. Funding acquisition: JNM, CAM. Investigation: JNM, CAM, EBSB, SLO, BPR, RCP. Methodology: JNM, CAM. Resources: JNM. Supervision: RCP. Visualization: CAM, BPR. Project administration: JNM. Software: BPR, CAM. Validation: RCP. Writing – original draft: RCP, JNM. Writing – review and editing: RCP, JNM, CAM.

Author ORCID iDs

Juliana Nascimento Martins  <https://orcid.org/0009-0007-4604-4112>

Cassiano Alves Marchett  <https://orcid.org/0000-0002-3099-4814>

Rodrigo Cambará Printes  <https://orcid.org/0000-0001-9673-2385>

Data availability

All data that support the findings of this study are available in the main text.

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